PUBLIC NOTICE

US Army Corps of Engineers ®
New England District

696 Virginia Road
Concord, MA 01742-2751

Date: October 12, 2004
Comment Period Ends: November 12, 2004
File Number: NAE-2004-965
In Reply Refer To: David M. Keddell

The Norfolk County Mosquito control district has requested a Corps of Engineers permit under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act of 1972 to implement Open Marsh Water Management (OMWM) in various towns in Southeastern Massachusetts. This work is to abate mosquito populations, reduce the need for insecticides, enhance the tidal food web, and enhance and restore previously adversely impacted salt marshes. The OMWM involves six types of alterations: pond, reservoir, radial, selective ditch, gutter ditch and sill ditch. Three-foot deep ponds will be utilized where depressions exist. Reservoirs will be three feet deep and will be utilized in areas where no existing depressions exist. Radials will be used to connect three or more ponds and reservoirs and will be eighteen inches deep. Circuit radials will also be eighteen inches deep and will be used to connect a pond or reservoir to another pond or reservoir. Selective ditches will be used to enhance tidal flow to an isolated breeding depression or tidally restricted salt marsh. They will be utilized to divert fresh water from an OMWM closed system. Gutter ditches will be utilized to maintain diversity by diverting surface freshwater or sheet runoff away from an OMWM closed system. Sill ditches will be used to enhance tidal flow to a closed system.

Many juvenile and adult EFH species utilize intertidal habitat, however the District Engineer has made a preliminary determination that the site-specific adverse effect will not be substantial. Further consultation with the National Marine Fisheries Service regarding EFH conservation recommendations is being conducted and will be concluded prior to the final decision.

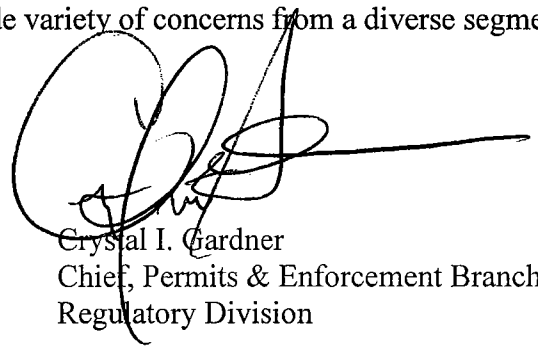
The applicant has applied to implement OMWM at a maximum of 40 sites in 4 communities if necessary for mosquito control. The applicant will submit data pertaining to proposed sites annually to the Corps of Engineers as part of the OMWM Committee review. The proposed work is described in the attached document entitled "Standard Open Marsh Water Management, OMWM". The sites are shown on the attached quadrangle sheet sections, on 23 sheets. A Corps of Engineers permit was issued in 1985, and 1998 for OMWM in Plymouth County, Massachusetts.

This project will impact approximately 8,000 acres of Essential Fish Habitat (EFH) for egg, larval, and juvenile stages of Atlantic salmon (Salmo salar), Atlantic cod (Gadus morhua), haddock (Melanogrammus aeglefinus), pollock (Pollachius virens), whiting (Merluccius bilinearis), offshore hake (Merluccius albidus), red hake (Urophycis chuss), white hake (Urophycis tenuis), redfish (Sebastes fasciatus), witch flounder (Glyptocephalus cynoglossus), winter flounder (Pleuronectes americanus), yellowtail flounder (Pleuronectes ferruginea), windowpane flounder (Scopthalmus aquosus), American plaice (Hippoglossoides platessoides), ocean pout (Macrozoarces americanus), Atlantic halibut (Hippoglossus hippoglossus), Atlantic sea scallop (Placopecten magellanicus), Atlantic sea herring (Clupea harengus), monkfish (Lophius americanus), bluefish (Pomatomus saltatrix), long finned squid (Loligo pealei), short finned squid (Illex illecebrosus), Atlantic butterfish (Peprilus triacanthus), Atlantic mackerel (Scomber scombrus), summer flounder (Paralicthys dentatus), scup (Stenotomus chrysops), black sea bass (Centropristus striata), surf clam (Spisula solidissima), ocean quahog (Artica islandica), spiny dogfish (Squalus acanthias), tilefish (Lopholatilus chamaeleonticeps), king mackerel (Scomberomorus cavalla), Spanish mackerel (Scomberomorus

maculatus), cobia (Rachycentron canadum). This habitat consists of tidally-influenced, upper estuarine silt/mud riverbottom, intertidal silt/mud, and estuarine marsh habitat. Loss of this habitat may adversely affect (name species, provide a brief description of impact to habitat or species and any anticipated mitigation). However, the District Engineer has made a preliminary determination that the site-specific adverse effect will not be substantial. Further consultation with the National Marine Fisheries Service regarding EFH conservation recommendations is being conducted and will be concluded prior to the final decision.

In order to properly evaluate the proposal, we are seeking public comment. Anyone wishing to comment is encouraged to do so. Comments should be submitted in writing by the above date. If you have any questions, please contact David Keddell at (978) 318-8692, (800) 343-4789 or (800) 362-4367, if calling from within Massachusetts.

Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider the application. Requests for a public hearing shall specifically state the reasons for holding a public hearing. The Corps holds public hearings for the purpose of obtaining public comments when that is the best means for understanding a wide variety of concerns from a diverse segment of the public.



SEE NEXT PAGE FOR
DETAILS OF EVALUATION
FACTORS

Crystal I. Gardner
Chief, Permits & Enforcement Branch
Regulatory Division

The decision whether to issue a permit will be based on an evaluation of the probable impact of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which may reasonably accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered, including the cumulative effects thereof; among those are: conservation, economics, aesthetics, general environmental concerns, wetlands, cultural value, fish and wildlife values, flood hazards, flood plain value, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food production and, in general, the needs and welfare of the people.

Where the activity involves the discharge of dredged or fill material into waters of the United States or the transportation of dredged material for the purpose of disposing it in ocean waters, the evaluation of the impact of the activity in the public interest will also include application of the guidelines promulgated by the Administrator, U.S Environmental Protection Agency, under authority of Section 404(b) of the Clean Water Act, and/or Section 103 of the Marine Protection Research and Sanctuaries Act of 1972 as amended.

Based on his initial review, the District Engineer has determined that the proposed work may impact properties listed in, or eligible for listing in, the National Register of Historic Places. Additional review and consultation to fulfill requirements under Section 106 of the National Historic Preservation Act of 1966, as amended, will be ongoing as part of the permit review process.

Pursuant to the Endangered Species Act, the District Engineer is hereby requesting that the appropriate Federal Agency provide comments regarding the presence of and potential impacts to listed species or its critical habitat.

The following authorizations have been applied for, or have been, or will be obtained:

(X) Permit, License or Assent from State.
(X) Permit from Local Wetland Agency or Conservation Commission.
(X) Water Quality Certification in accordance with Section 401 of the Clean Water Act.

The States of Connecticut, Maine, Massachusetts, New Hampshire and Rhode Island have approved Coastal Zone Management Programs. Where applicable the applicant states that any proposed activity will comply with and will be conducted in a manner that is consistent with the approved Coastal Zone Management Program. By this Public Notice, we are requesting the State concurrence or objection to the applicant's consistency statement.

The initial determinations made herein will be reviewed in light of facts submitted in response to this notice. All comments will be considered a matter of public record. Copies of letters of objection will be forwarded to the applicant who will normally be requested to contact objectors directly in an effort to reach an understanding.

THIS NOTICE IS NOT AN AUTHORIZATION TO DO ANY WORK.

If you would prefer not to continue receiving Public Notices, please contact Ms. Tina Chaisson at (978) 318-8058 or e-mail her at bettina.m.chaisson@usace.army.mil. You may also check here ( ) and return this portion of the Public Notice to: Bettina Chaisson, Regulatory Division, U.S. Army Corps of Engineers, 696 Virginia Road, Concord, MA 01742-2751.

NAME: _____

ADDRESS: _____

Norfolk and Plymouth County Mosquito Control Project

Standards for Open Marsh Water Management (OMWM)

Adapted from "Guidance for Meeting U.S. Fish and Wildlife Service Trust Resource Needs When Conducting Coastal Marsh Management for Mosquito Control on Region 5 National Wildlife Refuges" and OMWM Standards of The Northeast Massachusetts Mosquito Control and Wetlands Management District.

The Norfolk County Mosquito Control Project includes three communities that have coastal salt marshes (Braintree, Milton, Quincy, and Weymouth). Every one of these marshes has been altered in one way or another. Plymouth County Mosquito Control Project includes 11 coastal towns. Many of these marshes have been adversely impacted by human activities. In Wareham, Marion and Mattapoisett alone there are 58 tidal restrictions (Buzzards Bay Project national Estuary Program and Massachusetts Wetlands Restoration and Banking Program, 1999). Unaltered coastal salt marshes in the northeast are rare. Originally, these marshes had vast networks of salt ponds, pannes, potholes, and channels in the high marsh. Much of the water was semi-permanent, recharged only during spring high tide cycles, storm events, and precipitation. Since European settlement, the coastal marshes have been altered or damaged by various practices. High marsh grasses have been used for cattle grazing and harvested for use as feed hay or mulch. This resulted in drainage of or damage to, the salt marsh from ditching and wagon or tractor wheel ruts. The construction of roads and bridges either without culverts or with undersized culverts also has negatively impacted salt marshes by cutting off or severely reducing saltwater flow, resulting in drastic changes such as *Phragmites* invasion or conversion to other habitats (USDA Soil Conservation Service, 1994).

Bourn and Cottom (1950) estimated that over ninety percent of salt marshes in the northeastern United States were parallel-grid-ditched by 1938 for mosquito control under various state and federal programs. It is unknown how many acres of marsh have been manipulated for salt hay farming in the northeast. Grid-ditching was completed at a time when little was known about the ecology or importance of salt marshes to coastal ecosystems. Parallel-grid ditches for mosquito control were typically constructed at 100-150 foot intervals with cross ditches installed to drain permanent water areas (Whitman 1995). In many marshes, grid-ditches eliminated, reduced, and/or prevented panne and pool formation. For example, in Delaware's Great Marsh, over 40 acres of pond habitat existed in 1926. When reevaluated in 1986, only 10 acres remained due to the installation of grid-ditches (Meredith and Savelkis, 1987). The adverse impacts that indiscriminate salt marsh grid-ditching had on waterfowl, water birds, and shorebirds were recognized over fifty years ago in Massachusetts (Bradbury 1938).

Examples of negative impacts to migratory birds from marsh ditching include vegetation changes such as shrub or exotic species invasions replacing valuable habitat for: wintering waterfowl

(Widjeskog 1994), sparrows (Burger et al. 1978), and clapper rail production (Shisler et al 1979). In a Massachusetts study comparing avian use in ditched marshes versus unditched marshes, results showed significant decreased habitat use by shorebirds, herons, ibises, terns, and aerial insectivores in grid-ditched marshes (Clark et al. 1984). This study also investigated invertebrate abundance, suggesting that the cause of low avian use was loss of foraging opportunities due to prey inaccessibility rather than reduction in the abundance of invertebrates in the grid-ditched marsh. Migratory bird use impacts are still prevalent in many refuge coastal marshes that remain ditched and in some locations where ditching is still occurring. However, plugging these ditches or incorporating existing ditches into properly designed channels to facilitate water movement will encourage mosquito-eating fish without lowering the water table. The establishment of pools to provide semi-permanent reservoirs or sumps for these predatory fish also can furnish feeding and resting sites for migratory birds, resulting in both wildlife habitat improvement and mosquito control.

Marsh ditching results in the loss of submerged aquatic vegetation (SAV) with the loss of permanent pond habitat in the high marsh. SAV provides a vital link in the marsh food web for many small organisms that are eaten by fish, crustaceans and other predators. SAV is a broad category that includes attached macrophytes, epibenthic and floating algal mats, epiphytes, phytoplankton, benthic-diatoms and dinoflagellates (Mahaffy, 1987). Current studies evaluating parallel-ditch restoration (plugging of the ditch) show the return of wildlife and plant diversity such as fish, wading birds, shorebirds, waterfowl, and SAV to high salt marshes (Parker River NWR, Long Island Coastal Complex, and Great Bay NWR unpublished data 1995-1997).

After approximately 40 years of parallel-grid ditching for mosquito control, a new approach called Open Marsh Water Management began to emerge in the late 1960's in New Jersey (Ferrigno and Jobbins, 1968). This water management technique controls mosquitoes without using chemicals by altering the mosquito breeding habitat and by providing mosquito predaceous fish access to the managed areas. Biological control is achieved by fish predation (typically mummichogs (*Fundulus heteroclitus*), and other cyprinodontiform fish) on mosquito larvae. Since the inception of these techniques and modifications to the original techniques, northeastern states from Maryland to Massachusetts have increasingly used variations of OMWM for mosquito control, significantly reducing the need for chemical control. OMWM has evolved into a collection of marsh management techniques that facilitate source reduction and biological mosquito control and address specific high marsh problems (e.g., invasive plants), while improving fish and wildlife habitat.

There are numerous variations in the marsh management techniques between, and even within, the coastal states. The following Standards are adapted from The Northeast Massachusetts Mosquito Control and Wetlands Management District Standards for OMWM. The original Massachusetts standard for Open Marsh Water Management (OMWM) was written in 1982 by the then Essex County Mosquito Control Project, ECMCP. OMWM was seen by ECMCP as a long range salt marsh mosquito control strategy, and an environmentally sensitive alternative to the practice of maintaining grid ditches, which were primarily constructed during the 1930's. Environmental advocates saw OMWM as a means of discontinuing the practice of grid ditching, and possibly

even restoring some marshes to more naturally functioning ecosystems. A growing consensus that grid ditching had negative impacts on the salt marsh was the impetus for a cooperative effort between the ECMCP and many other groups and agencies, beginning in the early 1980's (Hruby, et al, 1985). Since OMWM had not previously been practiced in New England, and the fact that New England salt marshes were somewhat different environments from mid-Atlantic salt marshes, some modifications to techniques were required, as well as some preliminary test plots to determine if the method would be effective in New England. Several successful test plots and studies, led ECMCP to abandon grid ditching and OMWM became the preferred method from both the mosquito control and environmental perspective.

REFERENCES

Bourn, W.S. and C. Cottam. 1950. Some biological effects of ditching tidewater marshes. Research Report 19. Fish and Wildlife Service, U.S. Dept. of Interior, Washington, DC.

Bradbury, H. M. 1938. Mosquito control operations on tide marshes in Massachusetts and their effect on shore birds and waterfowl. J. Wildl. Manage. 2: 49-52.

Burger J., Shisler, J. and Lesser, F. 1978. The effects of ditching salt marshes on nesting birds, pp. 27-37. In: Proc. Colonial Waterbird Group. Northern Illinois Univ., Dekalb.

Buzzards Bay Project National Estuary Program and Massachusetts Wetlands Restoration and Banking Program. 1999. Atlas of tidally restricted salt marshes, Buzzards Bay Watershed Massachusetts. pp. 68.

Clark, J., B.A. Harrington, T. Hruby and F. E. Wasserman, 1984. The effect of ditching for mosquito control on salt marsh use by birds in Rowley, Massachusetts, J. Filed Ornithol. 55:160-180.

Essex County Mosquito Control Project. 1993. Standards for Open Marsh Water Management.

Ferrigno, F. and D. M. Jobbins. 1968. Open marsh water management. Proc. NJ Mosq. Exterm. Assoc. 55:104-115.

Hruby, T., W. G. Montgomery, R. A Lent, and N. Dobson. 1985. Open marsh water management in Massachusetts: Adapting the technique to local conditions and it's impact upon mosquito larvae during the first season. J. Am. Mosq. Assoc. 1:85-88.

Mahaffy, L. A. 1987. Effects of open marsh water management on submerged aquatic vegetation utilized by waterfowl in Delaware. Proceedings of a Symposium on Waterfowl and Wetlands Management. William R. Whitman and William H. Meredith, editors,; p. 323-332.

Meredith, W. H. and D. E. Savelkis. 1987. Effects of Open Marsh Water Management (OMWM) on bird populations of a Delaware tidal marsh, and OMWM's use in waterbird habitat restoration and enhancement, pp. 229-318. In: W.R. Whitman and W. H. Meredith (eds.), Waterfowl and Wetlands Symposium: proceedings of a symposium on waterfowl and wetlands management in the coastal zone of the Atlantic flyway. Delaware Coastal Management Program, Delaware Dept. Of Natural Resources and Environmental Control, Dover, DE.

Shisler, J.K., F. H. Lesser, and T. Candeletti. 1979. An approach to the evaluation of temporary versus permanent measures in salt marsh mosquito control operations. Mosq. News. 39: 776-780.

USDA Soil Conservation Service. 1994. Evaluation of restorable salt marshes in New Hampshire. 32 pp.

Whitman, W. R. 1995. Modifications of open marsh water management for wildlife habitat enhancement in Delaware. In: W.R. Whitman, et. al., ed. Waterfowl habitat restoration, enhancement and management in the Atlantic Flyway. Third ed. Environmental Manage. Comm., Atlantic Flyway Council Technical Section, and DE Div. Fish and Wildl., pp. E42-E65.

Widieskog, L. 1994. Duck habitat and Open Marsh Water Management. Proc. N.J. Mosq. Control Assoc. 81:48-51.

I. SITE SELECTION: From one or more of the sources listed below. The source of each site selection will be recorded with each site plan.

1. Mosquito Control larviciding site files.
2. Mosquito Control Field Technicians observation.
3. Requests of residents, or Federal, State or local public officials.

II. FIELD DIP STATION SURVEY: (Pre) To determine the need for and feasibility of OMWM alterations and to collect base line data for future considerations. The following procedure will be followed, and recorded weekly, for a 2-4 month period between May and September on an OMWM Field Survey Data Sheet, prior to any OMWM alterations.

1. Sites - Will not exceed 9 acres.

2. Photographic Record - A panoramic record of each site from one or more pre-chosen, recoverable stations, and/or aerial photographs will be taken.

3. Site Map - Each site will have an aerial photograph or map indicating the OMWM proposal, using symbols referenced in a legend.

4. Mosquito Larvae – Five to ten dip stations will be flagged on the marsh within each site. The location of these dip stations will be recorded on a map or aerial photograph.
   Procedure - At each dip station, 3 dips will be taken within a 3 yard radius around the station. The maximum larvae/dip to be counted will be 25.

5. Spring High Tide Events – a determination of tide height during the spring high tide event should be made, to make sure water will be able to reach all areas of a closed system. This can be done by a site visit during the spring high tide event. If a site visit is not feasible an

automatic data logger can be used or a simple stake method can be used. A black stake with chalk on 2 sides can be placed within the site to record the highest tide level.

6. Rainfall - Rainfall amounts will be monitored during the preliminary survey, using any accurate rain gauge on-site or nearby

7. Adult Mosquito - Will be monitored by means of a landing rate count. At least one count per visit using 1 minute or 5 minute intervals depending on existing conditions.

   Procedure - observer will count and record adult mosquitoes landing on the observer for a 1 or 5 minute interval. (Record interval on data sheet if different than 5 minute as noted on data sheet).

8. Mosquito Identification - Mosquitoes will be identified in the larval or adult stages.

   Procedure- Observer will collect larvae when present for identification. Larvae may be collected from one dip station per visit. Biting adults may also be collected for identification or identified in the field.

9. Salinity – Salinity can be a factor in determining whether invasive species control will work. Generally, *Phragmites* cannot survive in soil that is saturated with water of 35 parts per thousand or more.

   Procedure - observer will take and record readings at 1 or more stations depending on the diversity of the marsh habitat. If possible, readings will be taken from the same stations during each site visit. Some stations should be located near or in *Phragmites* stands.

10. Fish Populations - General observation.
    Procedure - observer will look for and record the presence or absence of fish in salt ponds or pans, stagnant ditches or flooded marsh surface within the site.

11. Shorebird Activity - General observation.
    Procedure - observer will look for and record the presence of shorebirds within the site which are resting, feeding or otherwise utilizing the site.

12. Human Activity - General observation.
    Procedure - Observer will look for and record the presence of human activity within or in the immediate vicinity of the site such as salt marsh haying, recreational activity, culverts, street drainage, etc.

III. SITE SURVEY SUMMARY - All data recorded on the Field Dip Station Data Sheet will be summarized on an OMWM Site Survey Summary Data Sheet for evaluation in order to determine the best abatement procedure. If the site does not meet the criteria listed below, OMWM alterations will not be warranted.

1. Site must produce 2 or more broods per season.

2. Dominant species must be *Ochlerotatus sollicitans, Ochlerotatus cantator , Ochlerotatus taeniorhynchus* or *Culex salinarius*.

3. Vegetation must consist mainly of *Spartina patens* or *Spartina alterniflora* or types of similar vegetation that are irregularly flooded by rains, spring or storm tides.

4. Ground conditions must be firm enough to support equipment necessary to implement OMWM alterations. Other considerations may be necessary according to conditions of the site.

IV. SITE PLAN - Considering all data and preexisting conditions alterations will be designed to meet OMWM objectives on all excepted sites.

1. Designed alterations will be flagged or staked on the marsh, the color of the flag determined by the type of alteration.

2. OMWM Design Map - A hand drawn map or a computer generated map will be created indicating alterations. The map should contain a key to mapped alterations.

3. Dig safe should be notified to determine if there are any utilities or easements crossing the salt marsh.

V. OMWM ADVISORY COMMITTEE

A committee consisting of federal, state, and local agencies plus other people from various relevant private interests, will be established to review each OMWM proposal and site before any alterations are made. At least once annually, all data pertaining to OMWM sites will be submitted to the committee for review. Any updates/revisions to this standard will be submitted to the committee for review.

Procedure - 1. Submit sites notification form including site pre-data summary and topographic map indicating location of site to Advisory Committee.
2. Review site data, conditions and proposed work during annual Advisory Committee meetings
3. The map and design overlay will be available upon request and site visits will be arranged as necessary.
4. From the date of notification there will be a 30 day period for written comment to the District/Project. In case of unresolved conflict, the U.S. Army Corps of Engineers will arbitrate.

VI. ALTERATIONS:

Seven types of alterations are available for OMWM - Site preparation, Pond, Reservoir, Radial, Selective Ditch, Gutter Ditch and Sill Ditch.

All alterations will be implemented with suitable equipment, preferably low ground pressure (LGP). Standard equipment may be used if operated on mats or other suitable devise designed to improve weight displacement. Equipment operating directly on the marsh surface will not exceed an operating weight of three and a half pounds per square inch (3.5 P.S.I.). Alterations will make use of existing topography, such as ponds, depressions, excavations, perimeter ditches and grid ditches, whenever possible. Spoil will be used to fill adjacent breeding depressions, plug unnecessary ditches or will be broadcast evenly over the marsh surface as thinly as possible. When alterations are in close proximity to the upland edge spoil will be moved to the upland and deposited off the marsh. When completed, alterations will be left open to tidal fluctuation for a period of one month or the next spring tide to flush the alterations of silt and sediment and promote higher levels of oxygen for predatory fish when the system is closed.

1. SITE PREPARATION: It may be necessary to prepare a site prior to implementing alterations.

A. Access and Egress - Bordering vegetation may be cut at a minimum necessary to provide safe operation of equipment to and from the site. Using only existing materials, earthen ramps may be constructed only as necessary to provide safe operation of equipment to and from site. Upon completion of work ramps will be re-graded to the approximate original condition.

B. Vegetation Management - Invasive stands of *Phragmities spp.* may be mowed or plowed for improved visibility, line of site for laser level operation, or safe operation of equipment. Mowing may result in short term stress to *Phragmities spp.*, a plant that is considered to be detrimental to a healthy salt marsh. A long term gradual reduction in *Phragmites spp.* may occur as a result of completed OMWM alterations.

C. Fill Removal - Fill material and debris may be excavated and removed from the site. The existing salt marsh grade adjacent to the fill area will be approximately replicated to promote restoration of a healthy marsh.

D. Vegetation Removal - In the course of implementing OMWM designed alterations and at the discretion of property owners, vegetation plugs may be removed from designated areas where ponds, pans or radials are to be excavated as directed by or under the supervision of District personnel and used for salt marsh restoration, projects within a one hundred mile radius of the removal site. State, municipal and non-profit groups will have priority over private (for profit) companies. Private (for profit) companies may charge contracted parties reasonable labor cost

for removal, transport and planting but may not charge for the plugs that are removed from OMWM sites.

2. POND:

A. Ponds will have a (3) foot deep area to provide adequate habitat for predatory fish during drought, and graduate up to marsh grade to promote wading shore bird and waterfowl use.

B. Ponds will be utilized on sites having depressions and will take the shape of the existing vegetation outline and profile.

C. Overflow ponds will be used to divert excess tidal water away from a plug during an out-going tide.

3. RESERVOIR:

A. Reservoirs will be three (3) feet deep to eliminate Mosquito breeding and provide adequate habitat for predatory fish during drought.

B. A Reservoir can be utilized in areas when there are no existing depressions on or in close proximity to the breeding marsh. Preferably adjacent to the upland edge and can be placed in a Radial to enhance fish movement and survival.

4. RADIAL:

A. Radials will be eighteen (18) inches deep, and can vary in width. They should preferably be meandering but can be straight if there are constraints that limit a meandering ditch.

B. Radials can be utilized to promote access and egress of predatory fish by connecting a Pond or Reservoir to another Pond or Reservoir, or connect a Pond or Reservoir to a breeding depression.

5. SELECTIVE DITCH:

A. Selective Ditches may vary in depth and width depending on the particular circumstances associated with a specific site. Most often and whenever possible, existing ditches or creeks will be used and the depth and width will conform to approximate original dimensions not to exceed 4 feet deep and 6 feet wide.

B. Selective Ditches may be utilized to enhance tidal flow to an isolated breeding depression usually in close proximity to a tidal channel or where a selective ditch would require less of an alteration than a Radial connecting to a closed system.

C. Selective Ditches may be utilized in areas where retention of surface water is impractical or undesirable, such as area where a discharge or culvert from another upland drainage system empties onto the marsh. Retention of surface water in such an area would reduce the efficiency of the upland draining system.

D. Selective Ditches may be utilized to divert fresh water from an OMWM closed system in order to reduce the encroachment of upland fresh water vegetation, in particular *Phragmites spp.*, which could cause habitat change and introduce upland species of mosquitoes to a closed system.

E. Selective Ditches may be utilized to enhance or restore tidal ebb and flow to a tidally restricted salt marsh.

6. SILL DITCH:

A. Sill Ditches will be utilized to enhance tidal flow to a closed system in an area of low tide range.

B. Depth of the Sill will be calculated by the height of the "mean high tide" in relationship to the marsh level of the target area. Sill ditches can vary in width and should preferably be meandering.

7. GUTTER DITCH:

A. Gutter Ditch will be utilized to maintain diversity by diverting surface fresh water or sheet runoff away from an OMWM closed system. This will retard the advancement of fresh water vegetation on to the salt marsh while preserving the integrity of the bordering fresh water wetland. In this instance a Gutter Ditch will be implemented on the "Palustrine Estuarine Interface". It may vary in width and depth sufficient only to divert surface runoff (not ground water) depending on the particular circumstances associated with a specific site.

VII. POST DIG FIELD DIP STATION SURVEY

To determine efficiency and effect of OMWM the procedure listed in section II., FIELD SURVEY will be followed for the below listed criteria and recorded monthly during the 2-4 month period between May and September on an OMWM Post Dig Dip Station Data Sheet for two breeding seasons after alterations are completed.

1. Photographic Record

2. Mosquito Larvae (Breeding levels and ID)

3. Adult Mosquito (Landing rates and ID)

4. Salinity

5. Fish Populations

6. Shorebird Activity

7. Human Activity

8. Site Review (Existing conditions, Corrections needed, system effectiveness)

VIII. POST DIG SITE SURVEY SUMMARY

All data recorded on the After Alterations Field Survey Data Sheet will be summarized on a Post Dig Site Survey Summary Data Sheet.

IX. EXAMPLE SURVEY SHEETS (see attached example sheets)

1. OMWM Field Dip Station Data Sheet.

2. OMWM Site Survey Summary Data Sheet.

3. Post-Dig Dip Station Data Sheet.

4. Post-Dig Site Survey Summary Data Sheet.

Norfolk and Plymouth County Mosquito Control Project
Open Marsh Water Management Field Survey
Field Dip Station Data Sheet

Date _____ Recorder(s)_____

District _____ Town _____Site Name _____

Time _____ Daily tide height and time: L_____ /time _____ H _____/ time_____

Date & Ht.of last Spring High Tide _____ Ht. _____ Rainfall (in) during last 10 days ____

Air Temp _____ 5 minute landing counts 1 _____2 _____3 _____4 _____ Ave._____

Adult species observed _____

Wildlife observed _____

Station	1	2	3	4	5	6	7	8	9	10	Mean
Station description											X
Dip 1											X
Dip 2											X
Dip 3											X
Mean/Station											
Dom. species											X
Other species											X
Water temperature											
Water salinity											
Fish (P or A)											X

Norfolk and Plymouth County Mosquito Control Project
Open Marsh Water Management Field Survey
Site Survey Summary Data Sheet

District _____ Town _____ Site Name _____

Land Owners _____

Wetland Description _____

_____

Vegetation Dominance Type _____ Subordinate plants _____

_____

Bordering Freshwater Wetlands _____

Surrounding Land Use _____

Wildlife observed _____

Date									Mean
Mean larvae/dip									
Maximum/dip									
Minimum/dip									
Dominant Species									X
Mean - landing count									
Dominant species									X
Days from last SHW									X
Average water temp.									
Average salinity									

Norfolk and Plymouth County Mosquito Control Project

Open Marsh Water Management Field Survey

Post Dig Field Dip Station Data Sheet

Site Name _____ Date _____ Recorder _____

Time _____ Daily tide height and time: L_____ /time _____ H _____/ time_____

Date & Ht.of last Spring High Tide _____ Ht. _____ Rainfall (in) during last 10 days ____

Air Temp _____ 5 minute landing counts 1 _____2 _____3 _____4 _____ Ave._____

Adult species observed _____

Wildlife observed _____

Station	1	2	3	4	5	6	7	8	9	10	Mean
Station description											X
Dip 1											X
Dip 2											X
Dip 3											X
Mean/Station											
Dom. species											X
Other species											X
Water temperature											
Water salinity											
Fish											X

Norfolk and Plymouth County Mosquito Control Project
Open Marsh Water Management Field Survey
Post-Dig Site Survey Summary Data Sheet

Site Name _____ Town _____

General comments on results and marsh recovery _____

_____

_____

_____

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_____

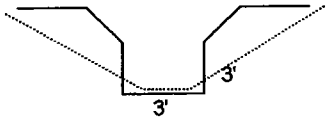
Wildlife observed _____

_____

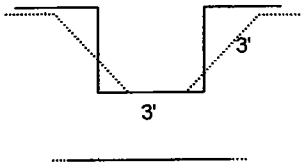
Date									Mean
Mean larvae/dip									
Maximum/dip									
Minimum/dip									
Dominant Species									X
Mean - landing count									
Dominant species									X
Days from last SHW									X
Range of water temp.									
Range of salinity									

ALTERATION DIMENSIONS AND PROFILE

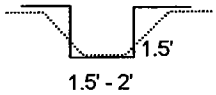
Pond L x 3' W x 3' D = L x 9' = cu ft *(L = diameter)



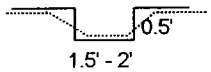
Reservoir L x 3' W x 3' D = L x 9' = cu ft



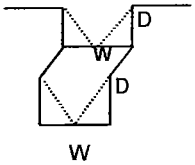
Selective Ditch Ditcher L x 1.5' W x 1.5' D = L x 2.25' = cu ft
Excavator L x 2' W x D = cu ft



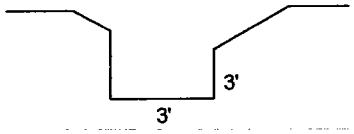
Gutter Ditch L x 2' W x 0.5' D = cu ft



Sill Ditch L x W x D + L x W x D = cu ft



Overflow Pond L x 3' W x 3' D = L x 9' = cu ft



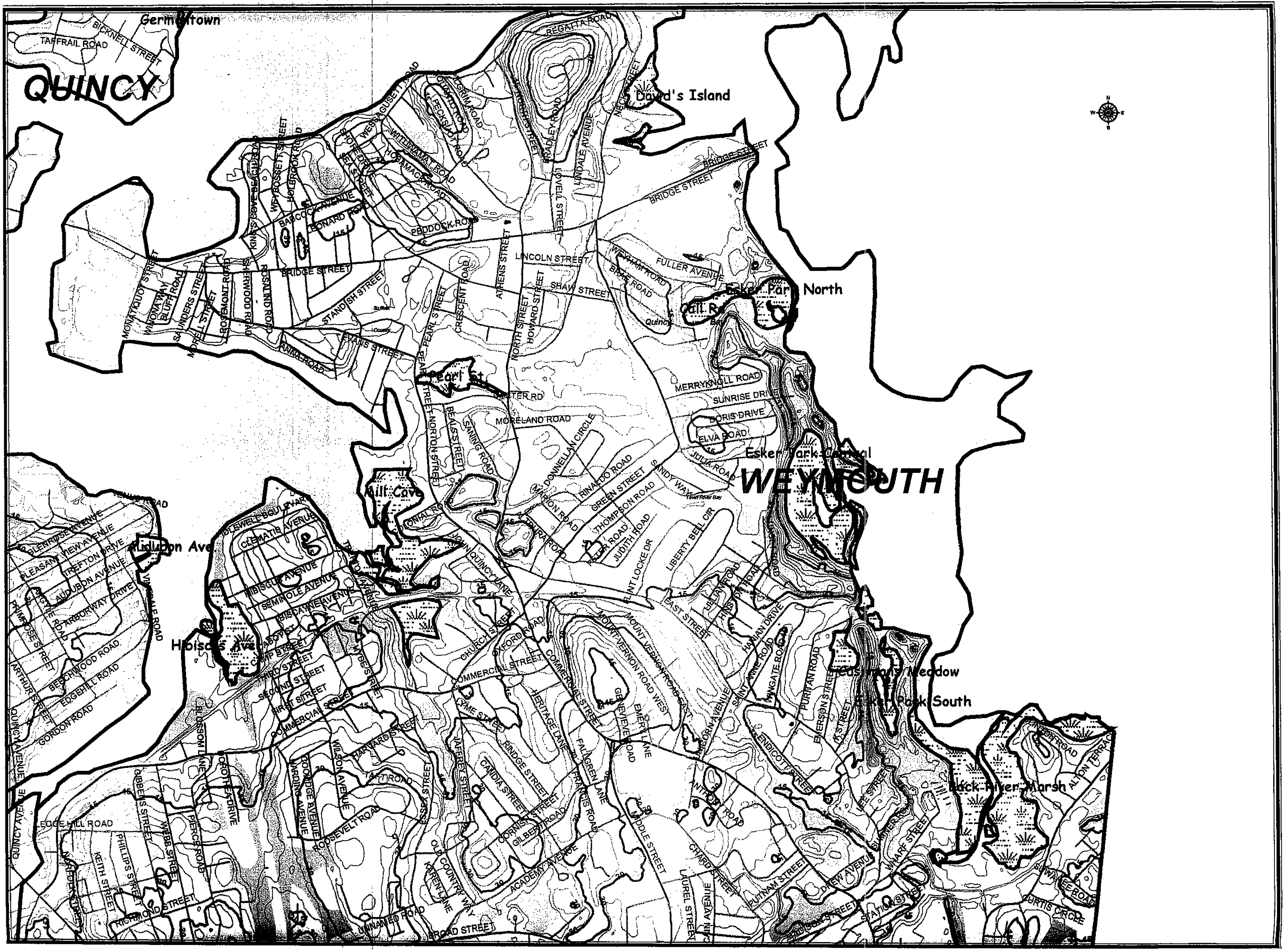
*(L = diameter)

* When measuring pond, an average diameter can be used for the length (L) depending on the pond configuration.

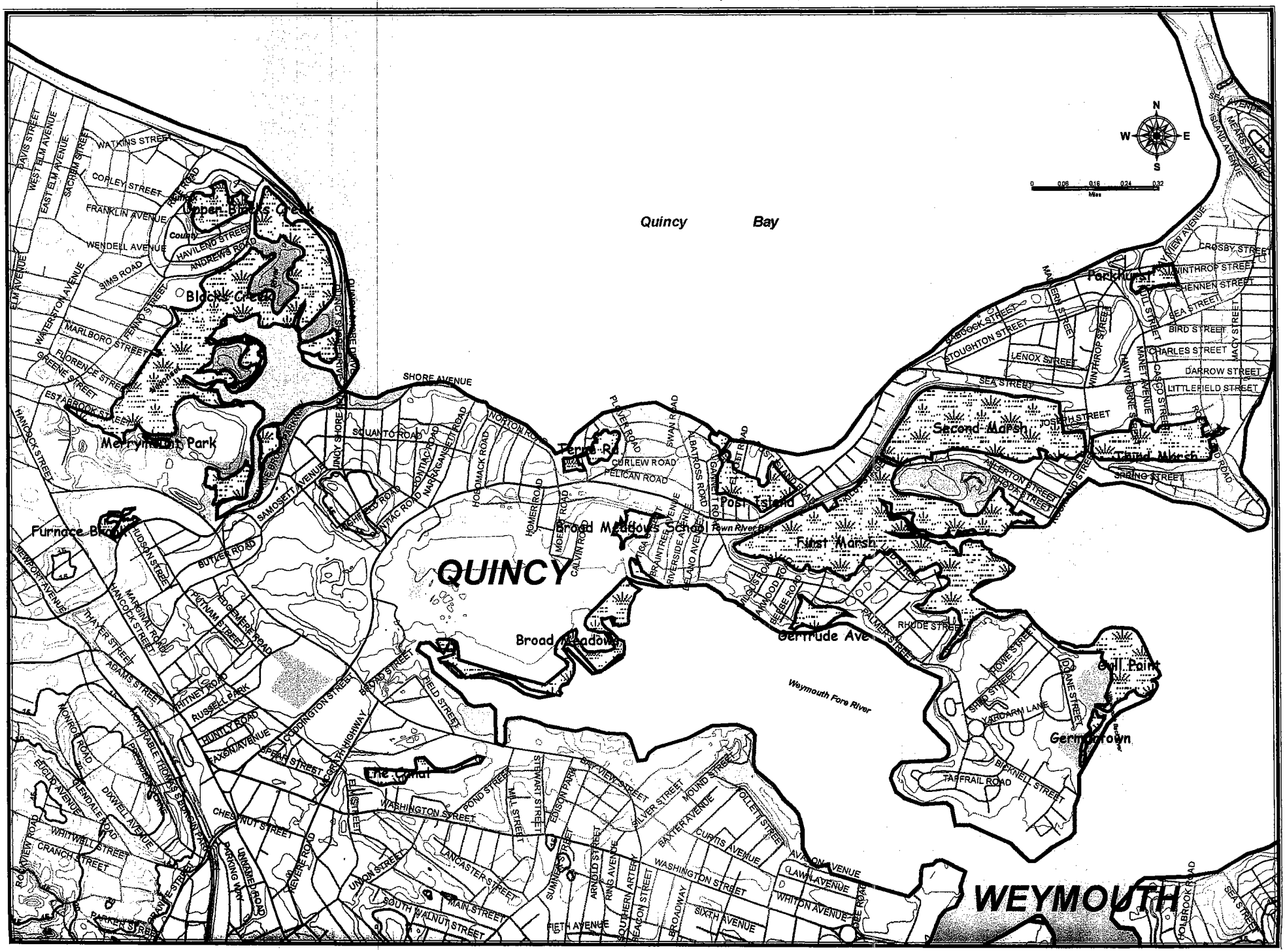
..... Indicates alternative design

Potential OMWM Sites in Braintree, MA

Salt Marshes of the Norfolk County Mosquito Control District



Salt Marshes of the Norfolk County Mosquito Control District



Salt Marshes of the Norfolk County Mosquito Control District